Appendix A

Appl. No.: 10/826,140
Amendment Dated Jul. 17, 2006
Reply to Office Action of Feb. 14, 2006

Declaration by Inventor Erik J. Brandon

I, Erik J. Brandon, am currently employed at the NASA Jet Propulsion Laboratory of the California Institute of Technology in the Materials and Device Technologies Group. I hold a Ph.D. degree in solid state chemistry, where my dissertation research focused on the development of novel, solution-processed, organic-based materials for use in devices. I have been employed at the Jet Propulsion Laboratory for the past 9 years, where I have focused much of my research on the fabrication and integration of organic electronics with heat-sensitive substrates for use in distributed sensing on inflatable and deployable structures.

As a person skilled in the art of organic electronics and specifically organic thin-film transistors ("OTFTs"), I am of the opinion that U.S. Patent Publication No. 2003/0228718 A1, (now U.S. Patent 6,774, 393) to Murti (hereinafter the "Murti patent"), does not enable one skilled in the art to make or use an OTFT using a fully solution-based process without undue or unreasonable experimentation. *United States v. Telectronics, Inc.*, 857 F.2d 778, 785, 8 USPQ2s 1217, 1223 (Fed. Cir. 1988).

The factors to consider when determining if sufficient evidence exists to support a determination that a disclosure does not satisfy the enablement requirement and whether any necessary experimentation is "undue" include: a) the breadth of the claims; b) the nature of the invention; c) the state of the prior art; d) the level of one of ordinary skill; e) the predictability in the art; f) the amount of direction provided by the inventor; g) the existence of working examples; and h) the quantity of experimentation needed to make or use the invention based on the content of the disclosure. MPEP §2164.01(a).

The concept of all polymer/solution based devices has been described as a general goal long before the Murti patent (see C. J. Druru, C. M. J. Mutsaers, C. M. Hart, et al., "Low-cost All-polymer Integrated Circuits, Applied Physics Letters, vol. 73, pp. 108-110, July 1998 and K. Saito and S. Kobayashi, "Deposition of Organic Electrodes Based on Wet Process for Organic Devices," Applied Physics Letters, vol. 80, pp. 1489-1491, February

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2002). Furthermore, in paragraph [0050] of the Murti patent, it states the gate electrode layer can be made from "a conducting polymer film, thin metal film, ink, or paste." It then states that the gate electrode layer can be prepared by "coating from conducting polymer solutions or conducting inks by spin coating, casting or printing." However, the use of a printed electrode *in and of itself* is not unique, for this concept has been reported in the literature twelve years ago (*Science*, volume 265, page 1685, September 1994).

More specifically, in the above mentioned *Science* article, a *solution-based, printed* electrode material is used with a *vacuum deposited* semiconductor to make a transistor device. In the Murti patent, transistor devices are made in which a *vacuum deposited* electrode (paragraph [0059] of Murti) is used with a *solution-based, printed* semiconductor (also paragraph [0059] of Murti).

What has long been a goal in this field of work is the ability to make a *fully solution processed* device. However, this presents a significant challenge. The fabrication of electronic devices involves the layering and patterning of many different films of various sorts of materials to make a functioning device. The challenge in creating a fully solution processed device is that the solvent from a top layer may re-dissolve and smear/degrade an underlying, previously deposited layer (where the solvent has dried already). It is addressing this specific challenge that is at the core of the present application.

In the present application, it is demonstrated that by judicious materials choice, an organic semiconductor can be deposited from solution on top of an electrode which was previously printed from a solution based carbon paste and still yield a functioning device. Details of a suitable process where we reduced this concept to practice (use of *solution-based, printed* carbon drain and source electrodes and a *solution-based* organic semiconductor) are given in paragraphs [42] through [46] of the present application. The electrode material must be chosen so as not to be dissolved by the solvent from the organic semiconductor, and this is detailed in paragraph [42] of the present application. Some suitable solvents are listed in Claim 9 of the present application. Finally, the combination of electrode material and semiconductor must possess the correct electrical

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properties to lead to the formation of an ohmic contact. We demonstrated this was achieved through the data in Figures 3 and 4.

An analysis of the undue experimentation factors detailed in MPEP §2164.01(a) demonstrates that the Murti patent does not satisfy the enablement requirement, in that the level of disclosure is too minimal to enable one of ordinary skill in the art to fabricate an OTFT using a fully solution-based process. Indeed, the Murti patent touches on the concept of fully solution-processed devices only in paragraph [0050], and makes no further mention of the concept in the claims. The nature of the Murti patent is instead directed to fabrication of a field effect transistor using only an organic semiconductor material. With regard to the state of the prior art, the above-listed references all demonstrate that although fully solution-processed devices had been postulated, none had been reduced to practice. Furthermore, the amount of direction provided by the Murti in explaining the specific steps in paragraph [0050] is general, and Murti fails to elaborate on what would otherwise be a fundamental breakthrough in the examples or the claims of the Murti patent. Murti also fails to disclose any working examples of a fully-solution processed device, providing instead examples in paragraphs [0056] – [0064] of devices made with the traditional vacuum evaporation step. As mentioned above, the actual reduction to practice of a fully solution-processed device requires the judicious choice of materials that will avoid dissolving the previously-applied semiconductor layer. These specific choices are detailed in the present application, and the generic description of the categories of materials required in the Murti patent provide further evidence that a great deal of experimentation is needed to arrive at the specific materials needed to make a fully-solution processed device.

In conclusion, as one of ordinary skill in the art, it is my opinion that the Murti patent's mention of a fully solution-based process for fabricating OTFTs is not sufficient to enable one of ordinary skill in the art to make a fully solution-processed OTFT. Furthermore, the disclosure in the Murti patent would not lead to any expectation of success without undue or excess experimentation.

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Signed: ______________________

Erik J. Brandon, Ph.D.

Date: 7-17-06